

REMARKS


Applicants submit this Preliminary Amendment to eliminate any multiple dependent claims, to place the application in better U.S. form for prosecution, and to include five (5) sheets of Replacement Pages, in accordance with the Annexes to the International Preliminary Examination Report. Please note that six (6) sheets of Replacement Pages are being submitted herewith, however the sixth Replacement Page concerns itself with claims which have been canceled by the present Preliminary Amendment and thus does not constitute a part of the application upon which examination is sought.

Applicants therefore respectfully request examination of the above-referenced application, as now amended.

No fees are considered to be due; however, if it is determined that payment of a fee is required, please charge our deposit account No. 13-0235.

Respectfully submitted,

By

  
Nicholas J. Tuccillo  
Attorney for Applicants  
Registration No. 44,322

McCORMICK, PAULDING & HUBER LLP  
CityPlace II, 185 Asylum Street  
Hartford, Connecticut 06103-4102  
Tel. (860) 549-5290

airbag by the inflator at any arbitrary time and to avoid a further inflation of the airbag.

5 From WO-A—98/01323, a device is known in which the gas bag comprises a ventilation opening which is closed at a frangible line or predetermined breaking line. The predetermined breaking line is designed to remain intact below a predetermined nominal pressure within the airbag and to automatically break open above the nominal pressure under the influence of the pressure. Such a predetermined breaking line is generally achieved by a thoroughly and technically  
10 precisely dimensioned weakening of the material employed. This weakening of the material can e.g. be effected by a perforation in which small incisions are disposed along the provided predetermined breaking line. In another embodiment, the predetermined breaking line is formed when closing the airbag by means of a seam produced by sewing, the thread used for sewing and the distance between the stitches being exactly mated to the demands of the airbag  
15 release. Alternatively, the airbag hull can also be closed by sealing, e.g. by ultrasonic sealing, with exactly adapted sealing patterns. In this case, the sealing seam is the predetermined breaking line.

20 From the EP-A-638 466, an airbag is known in which certain areas of the airbag material are slightly permeable to gas at a normal working pressure due to a purposeful weakening of the airbag material. These areas, the so-called dynamic vents, are for example formed by perforating the airbag material by means of a laser or by means of a needle punch. At a critical gas pressure  
25 above the normal working pressure, the gas escaping from the dynamic vents causes a melting or burning of the airbag material.

The problem with such predetermined breaking lines or dynamic vents, respectively, which automatically break open under the airbag pressure, is that due to  
30 the manufacturing tolerances an exact adjustment of the required nominal pressure at which the predetermined breaking line or the dynamic vent, respectively, breaks open is hardly possible.

A solution of this problem is to be found in controlled venting devices.

The document US-A-5,899,494, for example, describes an airbag device in which the inflating device is connected with the airbag by means of a distributor. The inflating device and the distributor are arranged in a housing which is gas-tightly sealed at one side of the airbag. The distributor as well as the housing are provided with a deflagration device which can burn a vent into the distributor or the housing, respectively, within a very short time after activation by an electrical pulse.

A controlled venting device is also described in the document GB-A-2 306 409. In this device, the airbag comprises a valve which is opened upon control by an electric signal. In a first embodiment, the valve comprises an expanded opening in the airbag material which is sealed by a sealing disc made of a meltable material. The disc comprises a predetermined breaking point with a reduced thickness to which a pyrotechnic charge is assigned at a distance. If the pyrotechnic charge is ignited by an electric signal, the same generates a flame which burns through the disc material in the region of the predetermined breaking point. Subsequently, the sealing disc further cracks open along the predetermined breaking point such that a fairly large vent is formed.

In another embodiment of the device from the GB-A-2 306 409, the airbag has a two-layer design. In the region of the valve, one of the layers comprises an opening which is sealed by a membrane formed by the second layer. A housing mounted at the airbag contains an ignitable pyrotechnic charge and a piston disposed between the pyrotechnic charge and the membrane and being provided with a cutting blade. By igniting the pyrotechnic charge, the piston is driven into the direction of the membrane, the cutting blade cutting the membrane, such that a vent is cut into the airbag.

**Object of the invention**

Consequently, it is the object of the present invention to propose another device for purposefully venting a gas bag.

5

**General description of the invention**

This object is solved according to the invention by a device for venting a gas bag made of a textile material, especially an airbag, with at least one ignitable pyrotechnic charge which is associated to the gas bag in a region such that, when the pyrotechnic charge is ignited, at least one thread of the textile material is destroyed in the region of the pyrotechnic charge. The pyrotechnic charge is in this case arranged directly at or in the textile material, so that, when the pyrotechnic charge is ignited, at least one thread of the textile material is directly destroyed by the explosion of the pyrotechnic charge. By the destruction of at least one thread of the textile material, commonly a woven or knitted fabric, the textile material can crack open at the respective site. Under the influence of the gas pressure in the interior of the gas bag, the textile material cracks further open at the respective site, so that a fairly large vent opening is formed through which the gas flowing into the gas bag can escape. Thereby, a further inflation of the airbag is effectively suppressed. It should be noted that the thread to be destroyed by the explosion is a "normal" thread of the textile material, e.g. a weaving or a knitting thread of the airbag, as well as a seam thread of a fastening seam formed by an appropriate production technique in the material of the gas bag, which thread is provided especially for this purpose. As soon as the seam fiber is broken at at least one site, the fastening seam can be opened without any expenditure of force if it is appropriately designed by special weaving or knitting techniques, respectively, and so the vent opening can be uncovered. It should further be noted that in case of a corresponding expansion of the pyrotechnic charge several threads of the textile material can be destroyed simultaneously, so that the vent opening quickly reaches the desired size.

In contrast to the presently known devices, the device according to the invention is actively triggered by igniting the pyrotechnic charge. This means that the venting operation can be triggered at any time in an exactly controlled manner. The triggering of the venting device can, for example, be effected by an airbag control module, after a sensor means has detected that a sufficient force or pressure level between the airbag and the passenger has been exceeded. The ignition of the pyrotechnic charge is preferably effected electrically, i.e. by an ignition pulse or an ignition current which is applied to the pyrotechnic charge by the control device, e.g. the airbag control, via connection lines and which heats the same to a temperature above the ignition temperature of the pyrotechnic charge.

**List of reference numerals**

**10 Airbag made of airbag material**

**5 12 Venting device**

**14 Pyrotechnic charges**

**16 Connection lines**

**10**

**18 Reinforcing seam**

**20 Filament**

**15**

**22 Explosive coating**

**24 Electrically conductive stranded wire**

**26 Explosive casing**

**20**

**28 Passenger**

**112, 114 Sections of the airbag**

**25**

**116 Multiple-row seam**

**118 Vent opening**

**120 Explosive thread**

**30**

### Patent Claims

1. Device for venting a gas bag made of a gas bag material, especially an airbag, with at least one ignitable pyrotechnic charge which is associated to the gas bag in a region such that, when the pyrotechnic charge is ignited, at least one part of the gas bag material in the region of the pyrotechnic charge is destroyed, characterized in that the gas bag material comprises a textile material and that the ignitable pyrotechnic charge is arranged directly on or in the textile material, so that, when the pyrotechnic charge is ignited, at least one thread of the textile material is directly destroyed by the explosion of the pyrotechnic charge.
2. Device according to claim 1, characterized in that the pyrotechnic charge is formed as an explosive thread which is introduced into the textile material of the gas bag or applied onto the textile material of the gas bag.
3. Device according to claim 2, characterized in that the explosive thread comprises an electrically conductive stranded wire which is surrounded by an explosive casing and/or into the interweaving of which an explosive is introduced.
4. Device according to claim 2, characterized in that the explosive thread comprises a thread made of an electrically conductive explosive material.
5. Device according to claim 1, characterized in that the pyrotechnic charge comprises a filament and an explosive coating, the filament being introduced into the gas bag or applied onto the gas bag and the explosive coating being applied onto the gas bag in the region of the filament.
6. Device according to claim 1, characterized in that the pyrotechnic charge comprises an explosive coating made of an electrically conductive explosive which is applied between two connection lines for the pyrotechnic charge onto the gas bag such that the explosive coating electrically contacts the two connection lines.